Table-projected music software with physical interaction.

- Extending the concept of keyframe interpolation into the domain of music

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Abstract

My project aims to structure and simplify the heterogenic, fragmented style of traditional music-sequencer software, which relies heavily on modes and sub-modes to perform various tasks.

I have applied two strategies. The first experiments with the physicality in the human/ machine interaction. The second explores geometric information visualization.

Using a single graphical object to visualize control-parameter-settings opens up for time-based transformations, extending the concept of keyframe interpolation from animation art into the domain of music. This approach offers the user a lot of creative feedback.

Keywords

Keyframe interpolation, physical interaction, multi-dimensional representation, image schemata

introduction

I have built a table-based soundfile editor, which utilizes various physical objects for sound manipulation and organizational task solving. (Figure 1)

(Figure 1)

The GUI is utilizing *one single holistic graphical object* for controlling relevant parameters. This gives the user a better overview of current ongoing musical events. The representation deals with isolation problems between individual sounds and thereby opening up for anticipation and comparison in the listening process.

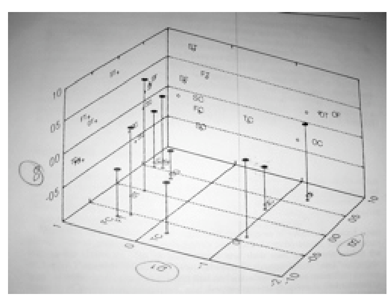
By taking a few contrasting snapshots of musical situations, represented by holistic graphical objects, the user may interpolate between the situations in time. This simple, but powerful technique gives a tool to create contrasts and consistent related variations, qualities which are fundamental and attractive for all time-based art.

My approach is partly motivated in frustration with existing software, and partly by two main principles in my own artistic working method. When developing a "new" synthesis model, I often use random generation of parameter-settings, combined with interpolation between the saved settings (presets), to search for interesting sounds. I find this to be a fruitful way to generate new related sounds.

A similar way of thought has been introduced by J. C. Risset [9] through the method of *analysis by synthesis*. Through synthetic imitation of a sound one may learn something about the sounding object by determining the most important parameters for imitation. Through imitation and effective representation one may also create interesting variants as by-products.

Holistic representation

The *musical object* is a well established metaphor in musicology, and has been a way of dividing the stream of sound in art music. The idea of the musical object is more adapt to the textural focus of contemporary music, and studio-based popular music. Its a"… multi-dimensional entity having a number of dimensions and sub-dimensions such as harmonic content, pattern of change or fluctuations in harmonic content etc" (R.I.Godøy, unfinished manuscript. University of Oslo, Dept. of musicology.)

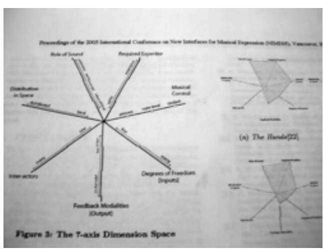


(Figure 2) [10]

The complex nature of timbre can effectively be visualized by means of multi-dimensional representation. (Figure 2) This is a way of visualizing various aspects of an entity in an n-dimensional conceptual space. This representation visualizes a broad range of qualities, and offers an environment well suited for system comparisons, and scaling.

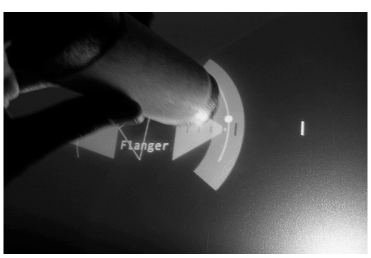
Implementation

I wanted to use a similar method for visualizing the most important control-parameters of various sound effects. Still it has proved more fruitful to work in two, rather than three dimensions, especially when dealing with time animations. [3] Deceptions of perspective often confuses the height and depth. I chose a similar 2-dimensional model introduced in design analysis with examples of comparisons of various music-systems by Birnbaum [2]. In this model several axis grow out from an origo-point. Each axis consists of a set of contrasting qualities. (Figure 3)



(Figure 3) [2]

This proved to be a fruitful model for the 2-dimensional table surface. I chose to let each ”quality” be a tentacle on a central graphical object. The objects represent a sounds with indication of strength, location in space, location in time and various effect-settings

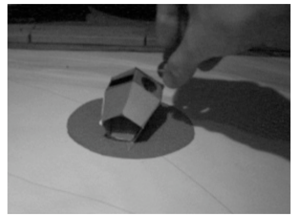
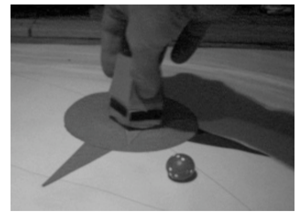


(Figure 4)

Each effect, and each of its parameters consist of two contrasting settings, which may be edited (red/green mode). The two settings can be interpolated (orange mode) (Figure 4) to create new consistently varied musical objects. I have tried to clarify this through symbolic coding. Aesthetically the red and green represents the contrasts, and the orange represent the consistent variations in between.

Geometrical shapes are well suited for information visualization. They can transmit a lot of information at a glance and relations between objects are still recognizable despite minor changes, and are thereby robust to deformation. We know also from popular experiences of memory mind maps, that simple geometrical shapes enhances our ability of short term memory greatly.

Physical interaction



(Figure 5 & 6) Prototype-scenario

I am hoping to further simplify the user experience by making metaphorical projections from *Image schemata* into the physical domain. This is a direction in cognitive psychology stating that we organize our impressions according to patterns, which is founded in the experience of our own bodies in interaction with the world. Future possibilities lies in

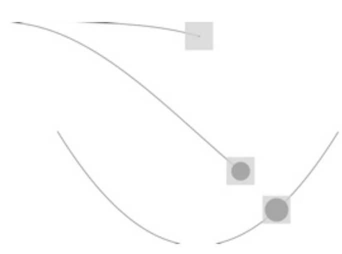
a) *turning old computer metaphors into the physical domain.* e.g. moving physical objects inside graphical objects to edit various soundqualities, instead of e.g. putting virtual documents inside virtual folders

Currently I use a multi-sensory resistor-based modal cube to access a few simple unified trinity modes: Play-freeze-stop, add-activate-delete, contrast-I – interpolate – contrast-II.

In addition I use a tracking object for positional movement, and rotational movement. This could be further extended to an object, which may be turned or filled. (Figure 5)

b) *Making metaphorical projections of “unused“ image schemata into the virtual domain.* e.g. the metaphor of objects moving on a path from point a to b.

Building on this idea I let the soundfiles be represented with graphical objects moving on paths in time (Figure 7), where the length of the line is the length of the soundfile and changes in control-parameters are visualized with continuous animated feedback.


(Figure 7)

Modes of interaction

The interface have three main modes of interaction.

- Distribution of soundfiles in the time-domain
- Editing (adding and deleting) presets fixed to a certain soundfile at a certain point in time.
- Playback of a session of saved parameter-settings with visual and auditory interpolation between presets.

Part 2 and 3 are currently realized.

By placing physical objects (PhO) on top of the graphical object (GO), PhO will be able to perform different editing tasks.

- *Movement Mode.* Volume (y-axis) "Panning" (rotation), time displacements (x-axis)

- *Orange Mode* (interpolation mode) is a high level control, where the various parameters for each effect is controlled by the alteration of one single graphical feature (tentacle).

By moving the PhO into one of the tentacles it may alter the relative mix between the different effects (x/ y axis), and interpolate between two extreme parameter-settings for the equivalent effect, by means of rotation

- *Green and red Mode* (contrast modes) By using a random generator one may generate interesting contrasting parameter-settings within the same effect. (These may be saved in the green and red mode.) This is a lower level of control, where all parameters are graphically available, both for random manipulation and manual fine-tuning. When the two extreme settings are fixed, one may interpolate between the two settings in the orange mode. When the user is satisfied with a certain object- setting, she may save it as a snapshot

The playback mode (Mode 3) will consist of different intersecting lines with objects moving on lines. (Figure 7) When playback is initiated the GOs start to move with the cursor until they reach the end of their line. The length of the lines represent the length of the soundfile, and the vertical direction is the volume. The GOs move on the lines and change continuously according to the interpolated values between time-presets (snapshots) containing information about volume, panning, effectmix (tentacle-size) and high-level control-interpolation (tentacle shape)

This multi-sensory environment (visual and auditory) gives the user a good overview of the current musical situation, and the ability for prediction of future events. By using colour or textural coding of tentacles the user would get a much more intuitive overview of ongoing events. An experienced user will start to recognize the objects as a holistic object, following the outlines of the tentacles, not having to perceive each tentacle individually.

Conclusion

I have described a table-based music sequencer/controller with physical interaction, which introduces keyframe interpolation into the domain of music, offering the user more creative feedback. It is simplified through holistic visual representation of sound but should nevertheless include most of the major features of a soundfile – sequencer, and thereby have the potential to be more than a toy for sounds.

Existing software are either dealing solely with the intuitive style of real-time editing and improvisation e.g. *Audiopad* , or with the accuracy of playback of saved settings. My interface is aiming to unify these aspects through the concept of musical keyframe interpolation.

Technology is widly availible today for a low cost, music software included. New users are overwhelmed by the technical possibilities and the fashyness of technology. By giving the user the task of choosing just a few contrasting settings she is offered a lot of creative feedback from the system.

Physical and technical configuration

Graphics and physical/virtual interaction in PROCESSING [8] , Sound and data-storage in MAX/MSP. [6]

Acknowledgements

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